

## Scientific Method

### What is a scientific method?

**Scientific method** is commonly used by researchers to investigate answers to their questions. Such approach uses a combination of **reasoning** and **observation**. At first, researchers formulate a **hypothesis** about how a certain process works. Then their hypotheses are tested or expanded based on **experiments**, from which measurements obtained, **inferences** are made and **theories** are derived.

### Scientific problem solving

In **scientific problem solving**, there is a certain sequence of techniques that people use for troubleshooting and forming theories. The first step is to define the **problem** that you are trying to solve. Then the current situation is evaluated using **observations**. Once the problem is defined and all the information regarding the problem is gathered, it is time to form hypotheses. Hypothesis generally state what the possible explanations are to the relative problem. Based on the different causes of the problem, possible outcomes are formulated. If A is the cause, B will happen, or if C is the cause, then D will happen. Then, experiments are set up to test the hypotheses and the solution to our original problem is discovered, based on the results obtained from the experimental outcome. Once the solution to the problem is established, it is good practice to repeat the experiments to make sure there are no mistakes. According to the scientific method, it is crucial that other people are able to repeat your experiment and get the same results.

Let's apply our scientific problem solving skills to an example problem. Olivia has a new plant that needs sunlight to grow. After a few weeks of getting the plant, the leaves start turning brown and Olivia is concerned that the plant might be getting too much light. We can follow the scientific problem solving rules to understand what is happening to Olivia's plant.

- 1. Define the problem:** The leaves of the plant are turning brown
- 2. Make observations & formulate a hypothesis:** The leaves are turning yellow in the sun, so maybe they are getting too much sunlight.
- 3. Set up experiment to test hypothesis:** Need an experiment to test if the yellow leaves are due to too much sunlight. Let's take three pots of the same plant (pot A, pot B and pot C) and keep them in the following conditions for two weeks.

**Pot A** → put in sunlight for the whole day, and treat the same way as Olivia has been already doing

**Pot B** → put in complete shade for the whole day

**Pot C** → put in partial sun light, where it gets sun for only half of the day

## Scientific Method (cont'd)

**4. Make observations & collect data from experiment:** After two weeks, observe the leaves of each plant and see if they are yellow or green.

**Pot A** → the leaves are brown and dry and the plant seems unhealthy

**Pot B** → the leaves are droopy, looking wilted and the plant seems unhealthy

**Pot C** → the leaves are green and the plant looks healthy

**5. Repeat the experiment several times:** Repeat steps 3 and 4 to make sure you get the same result each time. This ensures that the results are reproducible, there are no other external factors affecting the results and your theory has a solid basis.

**6. Formulate a theory and conclude.** Based on the experiments and the observations, it seems like the initial hypothesis was correct and that the leaves of Olivia's plants are turning brown due to too much sun.



## Scientific Method Answers

1. It is a method important for researchers to find answers to their questions. It uses a scientific approach to determine testable experiments in order to formulate a theory and answer a specific problem.
2.
  1. Define problem
  2. Make observation & formulate hypothesis
  3. Set up experiments to test hypothesis
  4. Make observations & collect data
  5. Repeat experiments & data collection
  6. Formulate a theory
3. **B**
4.
  1. Define problem: The cheese disappeared from the counter
  2. Make observation & formulate hypothesis: No one in the family ate the cheese and there was a mouse found in the house the previous week. The hypothesis is that a mouse ate the cheese.
  3. Set up experiments to test hypothesis: Set up a camera that attaches to the mousetrap with the cheese, so that if there is a mouse it will be caught and the camera will take a snap shot of the thief.
  4. Make observations & collect data: Look at the snapshots and check the mousetrap and see if there are any mice in the picture or the trap.
  5. Repeat experiments & data collection: Repeat this experiment for three nights.
  6. Formulate a theory: If the camera shots or the mousetrap shows a mouse eating the cheese, than our hypothesis is true.